An Investigation on the Nutritional Composition of Pleurotus Platypus and Pleurotus Eous Cultivated on Different Agricultural Substrates.

Sathyaprabha G¹*, Panneerselvam A²

Assistant Professor, PG and Research Department of Microbiology, Marudupandiayar College, vallam, Thanjavur, Tamil Nadu¹
Associate Professor, PG and Research Department of Botany and Microbiology, A.V.V.Sri Phuspam College (Autonomous), Poondi, Thanjavur, Tamil Nadu².

Correspondence Author*

Accepted 2017-06-15; Published 2017-07-26

Abstract:
Edible mushrooms have been a food supplement in various countries and they are cultivated and eaten for their edibility and delicacy. Mushroom had fall between the best vegetables and animal protein source. Because of rich source of protein content it overcomes the malnutrition. Mushrooms are considered as a distinctive food since the beginning of human evolution. As a fruit body of an edible white rot fungus, oyster mushroom belongs to Pleurotus, Pleurotaceae, Agaricales and Basidiomycota. Two species (Pleurotus platypus and Pleurotus eous) of oyster mushroom were grown on different substrates like Paddy straw, Black gram waste, Teak leaves, Banana leaves and Sugarcane trash. The biochemical analysis confirms that the protein, carbohydrates, fiber, fat, moisture, energy, Vitamin – C, in fresh Pleurotus eous and Pleurotus platypus were found to be altered by the substrates. In the present investigation, the nutrient contents were maximum in Pleurotus eous and Pleurotus platypus when the paddy straw was used as a substrate.

Keywords: Pleurotus platypus, Pleurotus eous, Agricultural wastes, Nutritional analysis and HPLC Techniques.

Introduction:
A mushroom is a macrofungus which have fruiting body either epigeous or hypogenous. Mushroom fruiting bodies are large enough to be seen through the naked eye and easy to pick up by hand. Mushroom have achieved as food, medicine and cosmetics in worldwide¹. Mushrooms are considered as rich source of protein, fiber and mineral content with low fat². The consumption of wild edible mushroom is increasing because of rich nutritive value and medicinal properties³. Because of rich nutritive properties seven wild edible mushrooms are commonly consumed by the peoples of khasi hills of Meghalaya⁴. Edible mushrooms are recommended for the countries suffering from malnutrition ‘Protein Gap’ in Asian, African and many developing countries⁵. The traditional source of protein production may help to overcome malnutrition. Mushrooms are grown on some organic substrates, mostly waste materials from farms, plantations or factories. These otherwise useless by-products can therefore be recycled to produce value- added
mushrooms currently; millions of tons of agricultural wastes are discarded, burned and neglected. In the process of mushroom growing, however, environmental pollution from such practices may be reduced. Agro- wastes in abundance in the tropics are straw, corncobs, grass, sawdust, sugarcane bagasse, cotton waste, oil palm waste, coffee pulp and waste hyacinth plants, coconut husks, tree leaves, branches and logs. These all can be used alone or in combination to create mushroom growing substrate.

Considering the importance of mushroom as a good source of protein and its role in degrading the wastes, especially the agricultural residues, this study is concerned with the evaluation of suitable agro-industrial wastes for cultivation of *P. platypus* and *P. eous* by finding its yield and nutritional status on those substrates.

**Materials and Method:**

**Proximate Analysis of Fresh Pleurotus platypus and Pleurotus eous:**

Fresh *Pleurotus platypus* and *Pleurotus eous* were analyzed for chemical composition (Moisture, Protein, Fat, fiber, Carbohydrates, Total ash and Insoluble Ash) by using the AOAC procedures.

**Moisture Content:**

Five grams of the test sample was taken in weighing dish and it was placed in an hot air oven which was previously heated to standard temperature. The cover of the weighing dish was removed and heated for six hours at 105°C. The cover of weighing dish was replaced, cooled to room temperature and weighed.

**Estimation of ash content:**

Four grams of well mixed test sample was weighed into a shallow, relatively broad ashing dish (silica crucible) and it was ignited in a furnace at approximately 800°C for 5 hours (dull red) until light gray ash results or to constant weight. Then it was cooled and weighed at room temperature.

**Estimation of insoluble ash content:**

The ashed sample was mixed with 1:1 Hydrochloric acid and heated on a hot plate to boil all carbonaceous matter, filter in to a 250 ml volumetric flask and washed with hot water. Then the residue together with the filter paper was taken in a silica crucible and burn in to white ash into an oven at 105°C for four hours. It was cooled and weighed after reaching room temperature.

**Estimation of crude fibre content:**

2g of powdered sample and add to 200ml of 1.25% H2SO4 held in a 500ml beaker. Cover the beaker and boil for 30 minutes. Make up any loss in volume during boiling with distilled water. Filter the hot solution through a cotton cloth and it residue well with distilled water. Wash the residue back in the beaker with a total of 100 ml hot distilled water. Add 200ml of 1.25% Sodium Hydroxide solution. Boil for 30 minutes making up any volume loss with distilled water. Filter the liquid through a cotton cloth wash with hot distilled water until the washing is no longer alkaline. Dry the residue at for 3 hours and weighed to constant weight.

**Estimation of protein:**

One gram of the test sample was taken in the digestion flask (Gerhardt - Turbertherm). 10 grams of potassium sulphate, or sodium sulphate, 1 gram of cupric sulphate, 1 gram of mercuric oxide, pinch of selenium dioxide and 20 ml of concentrated sulphuric acid where added to this. The digestion tubes are then placed in the digestion chamber and the sample was digested for about three hours until solution become clear. 20 ml of water was added to this digested sample and it was distilled with 40% of sodium hydroxide solution containing 40 ml of 4% boric acid and two drops of mixed indicator. The steam of distillate was collected in a flask and it was titrated against 0.1N hydrochloric acid solution. A blank was also calculated.

**Estimation of carbohydrate:**

Weight 100mg of the sample into a boiling tube. Hydrolyze by keeping it in a boiling water bath for three hours with 5ml of 2.5N hydrochloric acid and made upto100 litre, placed at room temperature. Neutralize it with solid sodium carbonate until the effervescence cases. Make up the volume to 100 ml and centrifuge. Collect the supernatant and take 0.1 and 1ml. Prepare the standard by taking 0.2, 0.4, 0.6, 0.8 and 1ml of the working standard. Make up the volume to 1ml in all the tubes including the sample tubes by adding distilled water. Then add 4ml of anthrone reagent and boiled for eight minutes in a boiling water bath. Cool rapidly and read the green to dark green color at 630 nm.
Energy Value:

The total energy was calculated according to the following equations:

Energy (kcal) = 4(g protein + g carbohydrate) + 9(g lipid).

Vitamin Analysis of fresh Pleurotus platypus and Pleurotus eous:

Estimation of Vitamin – C9:

Pleurotus platypus and Pleurotus eous were subjected to estimate the amount of vitamin – C content. Ascorbic acids were used as standard chemicals; 100 mg of ascorbic acid were dissolved in 4% oxalic acid. 1gm of sample was taken and crushed with the help of mortar and pestle and dissolved the sample in 4% oxalic acid and make up to 100 ml. 5 ml of prepared sample was taken and added 10 ml of 4% oxalic acid and titrate against 2-dichloro phenol. Blank readings and sample readings were noted.

Results:

Effect of substrates in Moisture of fresh Pleurotus platypus and Pleurotus eous:

Moisture content of Pleurotus platypus were showed in all five substrates, low moisture content were present in paddy straw substrates 90.19±0.01 %, and highest moisture in Black gram pods 90.34±0.20%. Sugarcane trash, Teak leaves and banana leaves showed the moisture leave as 90.22±0.02 %, 90.30±0.04 and 90.32±0.22%.

Table: 1 Proximate analysis of Pleurotus platypus in various substrates

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the substrate</th>
<th>Paddy straw</th>
<th>Sugarcane trash</th>
<th>Teak leaves</th>
<th>Black gram pods</th>
<th>Banana leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisture</td>
<td>90.19±0.01</td>
<td>90.22±0.02</td>
<td>90.30±0.04</td>
<td>90.34±0.20</td>
<td>90.32±0.22</td>
</tr>
<tr>
<td>2</td>
<td>Fat</td>
<td>0.24±0.05</td>
<td>0.30±0.02</td>
<td>0.31±0.04</td>
<td>0.34±0.04</td>
<td>0.26±0.04</td>
</tr>
<tr>
<td>3</td>
<td>Protein</td>
<td>5.69±0.0</td>
<td>5.68±0.02</td>
<td>5.60±0.04</td>
<td>5.63±0.06</td>
<td>5.48±0.07</td>
</tr>
<tr>
<td>4</td>
<td>Fiber</td>
<td>1.19±0.00</td>
<td>1.15±0.01</td>
<td>1.14±0.02</td>
<td>1.14±0.04</td>
<td>1.14±0.07</td>
</tr>
<tr>
<td>5</td>
<td>Total Ash</td>
<td>0.67±0.01</td>
<td>0.64±0.05</td>
<td>0.65±0.07</td>
<td>0.59±0.20</td>
<td>0.55±0.06</td>
</tr>
<tr>
<td>6</td>
<td>Insoluble Ash</td>
<td>0.65±0.01</td>
<td>0.63±0.04</td>
<td>0.63±0.05</td>
<td>0.58±0.04</td>
<td>0.52±0.03</td>
</tr>
<tr>
<td>7</td>
<td>Carbohydrate</td>
<td>3.20±0.09</td>
<td>3.16±0.02</td>
<td>3.14±0.11</td>
<td>3.10±0.16</td>
<td>3.31±0.39</td>
</tr>
<tr>
<td>8</td>
<td>Energy</td>
<td>37.72±1.01</td>
<td>38.06±0.98</td>
<td>37.66±1.13</td>
<td>37.98±1.21</td>
<td>38.22±1.10</td>
</tr>
</tbody>
</table>

Table: 2 Proximate analysis of Pleurotus eous in various substrates

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the substrate</th>
<th>Paddy straw</th>
<th>Sugarcane trash</th>
<th>Teak leaves</th>
<th>Black gram pods</th>
<th>Banana leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisture</td>
<td>91.69±0.34</td>
<td>90.97±0.25</td>
<td>91.98±0.33</td>
<td>91.80±0.30</td>
<td>91.38±0.27</td>
</tr>
<tr>
<td>2</td>
<td>Fat</td>
<td>0.19±0.02</td>
<td>0.19±0.03</td>
<td>0.23±0.04</td>
<td>0.21±0.06</td>
<td>0.22±0.03</td>
</tr>
<tr>
<td>3</td>
<td>Protein</td>
<td>5.17±0.16</td>
<td>4.99±0.19</td>
<td>4.99±0.18</td>
<td>5.04±0.12</td>
<td>4.95±0.07</td>
</tr>
<tr>
<td>4</td>
<td>Fiber</td>
<td>0.98±0.06</td>
<td>0.88±0.14</td>
<td>0.87±0.12</td>
<td>0.88±0.12</td>
<td>0.93±0.09</td>
</tr>
<tr>
<td>5</td>
<td>Total Ash</td>
<td>0.58±0.13</td>
<td>0.55±0.07</td>
<td>0.50±0.20</td>
<td>0.49±0.06</td>
<td>0.46±0.05</td>
</tr>
<tr>
<td>6</td>
<td>Insoluble Ash</td>
<td>0.35±0.11</td>
<td>0.27±0.05</td>
<td>0.30±0.11</td>
<td>0.38±0.13</td>
<td>0.48±0.04</td>
</tr>
<tr>
<td>7</td>
<td>Carbohydrate</td>
<td>2.36±0.68</td>
<td>2.98±0.76</td>
<td>2.29±0.37</td>
<td>2.46±0.30</td>
<td>2.97±0.42</td>
</tr>
<tr>
<td>8</td>
<td>Energy</td>
<td>31.85±1.78</td>
<td>33.65±3.53</td>
<td>31.21±0.40</td>
<td>31.89±1.13</td>
<td>33.72±1.13</td>
</tr>
</tbody>
</table>
Moisture content of *Pleurotus eous* was denoted that minimum level in Teak leaves (91.98±0.33 %) and the minimum level of moisture is 90.97±0.25 %, while other three substrates showed that, 91.38±0.27 %, 91.69± 0.34 and 91.80±0.30 % of moisture. Results were showed in Table: 1&2 and Fig: 1:

**Effect of substrates in Fat content of fresh Pleurotus platypus and Pleurotus eous:**

In *Pleurotus platypus* low fat content 0.24±0.05g/100 gm were present in paddy straw substrates, while all other substrates showed the slightly high level Sugarcane trash, Teak leaves substrates were showed the same level of fat content 0.30±0.02g/100 gm. Black gram pods and Banana leaves substrates were showed the same content 0.34±0.04mg/100gm.

In *Pleurotus eous* paddy straw substrates and Sugarcane trash substrates were showed the minimum level of fat content which is 0.19±0.02 g/100gm, while teak leaves showed the 0.23±0.04 g/100gm of fat content. Banana leaves showed the 0.22±0.03 g/100gm and Black gram pods showed that 0.21±0.06 g/100gm of fat. Results were showed in Table:1&2 and Fig:2

**Effect of Protein content of fresh Pleurotus platypus and P.eous:**

In *Pleurotus platypus* paddy straw showed the maximum level of protein content 5.69 g/100 gm, second minimum level of protein was showed that 5.68±0.02 g/100 gm. Banana leaves substrates showed that minimum level of protein. 5.48±0.07 g/100gm of protein in teak leaves and black gram pods showed that 5.60±0.04 g/100gm and 5.63±0.06 g/100gm.

In *Pleurotus eous* 5.17±0.16 g/100gm of protein was found in Paddy straw substrates and it’s the maximum level when compared to other substrates. 4.95±0.07 g/100gm of protein is the lowest level in Banana leaves substrate. Sugarcane trash and Teak leaves were showed the same level 4.99±0.19 g/100gm of protein. Black gram pods showed the maximum level 5.04±0.12 g/100gm of protein. Results were showed in Table:1&2 and Fig: 3

**Effect of substrates in fiber content of fresh Pleurotus platypus and P.eous:**

Paddy straw substrates showed that 1.19±0.0 g/100 gm of fiber, but all other three substrates in Teak leaves substrates, 1.14±0.02 g/100 gm, and Black gram pods 1.14±0.04 g/100 gm and Banana leaves 1.14±0.07 g/100 gm. Sugar cane trash showed that 1.15±0.01 gm/100gm of fiber content. In *Pleurotus eous* paddy straw substrates showed the high level of fiber content 0.98±0.06g/100gm,that minimum level of fiber content was 0.87±0.12g/100gm. 0.93±0.09 g/100gm of fiber were found in Banana leaves,
Sugarcane trash and Black gram pods substrates were showed the same level of fiber content 0.88±0.14 g/100gm and 0.88±0.12 g/100gm. Results were showed in Table: 1&2 and Fig: 4

**Effect of substrates in Total Ash content of fresh Pleurotus platypus:**

Total ash content of *Pleurotus platypus* showed in 0.67±0.01 g/100 gm, while Sugarcane trash showed that 0.64±0.05 mg/100 gm of total ash Second maximum level of total ash content were present in Teak leaves 0.65±0.07 g/100 gm. Black gram pods and Banana leaves showed that 0.59±0.20 g/100 gm and 0.55±0.06 mg/100 gm. In *Pleurotus eous* total ash content was showed the maximum level 0.58±0.13 g/100gm in Paddy straw substrates and the minimum level in Banana leaves 0.46±0.05 g/100gm. Other three substrates, such as Sugarcane trash, Black gram pods and Teak leaves showed that 0.55±0.07, 0.5±0.20 and 0.49±0.06 g /100gm of total ash. The results are shown in Table: 1&2 and Fig: 5.

**Effect of substrates in Insoluble Ash content of fresh Pleurotus platypus and P.eous:**

In *Pleurotus platypus* 0.63±0.04 g/100gm of insoluble ash was present in Sugarcane trash and Teak leaves substrates. Black gram pods and Banana leaves substrates were showed that 0.58±0.04 g/100gm and 0.52±0.03 g/100gm of insoluble ash. Paddy straw substrates showed that 0.65±0.01 g/100gm of Insoluble Ash content.

In *Pleurotus eous* among five substrates Banana leaves substrates showed that maximum level of insoluble ash (0.48±0.04g/100gm). Black gram pods showed that 0.98±0.13g/100gm, that minimum level of insoluble ash were showed in sugarcane trash. Teak leaves substrates showed 0.30±0.11g/100gm. Paddy straw substrates showed the high level of fiber content 0.98±0.06g/100gm,that minimum level of fiber content was 0.87±0.12g/100gm. 0.93±0.09 g/100gm of fiber were found in Banana leaves, Sugarcane trash and Black gram pods substrates were showed the same level of fiber content 0.88±0.14 g/100gm and 0.88±0.12 g/100gm. Results were showed in Table: 1&2 and Fig: 6

**Effect of substrates in carbohydrates of fresh Pleurotus platypus and P.eous:**

In *Pleurotus platypus* 3.31±0.3 g/100gm of carbohydrates was present in Banana leaves, while minimum levels of carbohydrates were showed in 3.10±0.16 g/100gm. Teak leaves substrates were showed in 3.14±0.11 and Sugarcane trash substrates showed that 3.16±0.02 g/100gm of carbohydrates. Paddy straw shows that 3.20±0.07 g/100gm.

In *Pleurotus eous* 2.29±0.37 g/100gm of carbohydrate was showed in teak leaves, 2.98±0.76 g/100gm of carbohydrate were showed in Sugarcane trash. Maximum levels of carbohydrate were showed in 2.98±0.76 g/100gm in sugarcane trash. Banana leaves showed that 2.97±0.42g/100gm. Black gram pods were showed 2.46±0.30 g/100gm and 2.36±0.68 g/100gm in Paddy straw substrates and Black gram pods. Results were showed in Table: 1&2 and Fig: 7:
energy were present as 38.06±0.05 k/cal. Black gram pods were showed as 37.98±0.12k/cal. 37.66 k/cal and 37.72 k/cal were present in Paddy straw and Teak leaves.

In Pleurotus eous 33.72±1.13k/cal of energy was showed in banana leaves substrates and it’s the maximum level of energy. Second maximum levels of energy were 33.65±3.53k/cal in Sugarcane trash. Paddy straw and Black gram pods were showed that 31.85±1.78 k/cal and 31.89±1.13 k/cal of energy. Teak leaves showed that 31.21± k/cal of energy.

**Results were showed in Table:1&2 and Fig: 8**

**Effect of substrates in vitamin –C analysis of Pleurotus platypus:**

Vitamin – C were analyzed from Pleurotus platypus which had been cultivated and harvest from different agricultural wastes, Paddy straw, Sugarcane trash, Teak leaves, Black gram pods and Banana leaves. According to the results, Teak leaves substrates shows the maximum level of vitamin – C 5.90±0.4 mg/100gm and paddy shows that minimum level 5.73±0.03 mg/100gm of vitamin –C. Banana leaves shows that 5.75±0.05 mg/100 gm of vitamin – C Sugarcane trash (5.86 mg/100gm) and Black gram pods shows that 584.30 mg/100gm of vitamin –C.

Ascorbic acid was subjected as standard to compare with Pleurotus eous, which had been cultivated from different agricultural substrates. Among the different substrates banana leaves shows the maximum level of vitamin-C (4.67±0.06 mg/100gm) and minimum level in sugarcane trash (4.52±0.07 mg/100gm). Results were showed in Table:1&2 and Fig: 9

**Discussion and Conclusion:**

Edible mushroom production from agrowastes can be a very effective weapon in fighting malnutrition. Mushrooms are composed of nitrogen compounds, especially protein, amines, aminoacides, nucleic acids, chitin and urea.

In our study Pleurotus platypus and Pleurotus eous showed the nutritional facts such as moisture, protein, fat, fiber, total ash, insoluble ash, carbohydrates and energy value. Moisture was highest in Pleurotus eous 91±0.39% and Pleurotus platypus contains 90.27±0.06 of moisture. Protein was highest in Pleurotus platypus 5.61±0.08% and in Pleurotus eous was 5.02±0.08. Pleurotus platypus and Pleurotus eous was showed the fat content as 0.30±0.04% and 0.20±0.01%. Fiber content of Pleurotus platypus and Pleurotus eous was 5.15±0.02 and 4.90±0.04%. Total ash content was high in Pleurotus platypus 0.62% and 0.5% in Pleurotus eous. Insoluble ash showed the maximum in Pleurotus platypus 0.60±0.05% and Pleurotus eous shows 0.35±0.08. Carbohydrate shows that 3.18±0.08% in Pleurotus platypus and 2.61±0.33% in Pleurotus eous.

Energy content was 37.92±0.23% in Pleurotus platypus and 32.46±1.14 in Pleurotus eous. Reported that mushrooms have been evaluated for their nutritional status on the basis of their chemical composition. Cultivated and wild mushrooms contain reasonable amounts of proteins, carbohydrates, minerals, fibers and vitamins. demonstrated that other species are recommended to diabetic and anemic persons, owing to their Low carbohydrate and high folic acid content. Some mushrooms are reputed to possess anti allergic, anti-cholesterol, anti-tumour and anti-cancer properties. Mushrooms are high I protein, carbohydrate and dietery fibre but low in energy and fat content. Nutritional analysis of P.citrinopileatus showed 22.10% of protein while the fat was 1.32% and fibre 20.78%.
Reported that vitamin C contents of studied species were between 4.21 and 6.05 mg/100g. It had been reported between 5.22 and 7.36 mg/100g for Lactarius delicosus, 2.5 mg/100gm for A.rodmani and 2.3 mg/100gm for A.Campestris vitamin C levels are variable among species. In our study Pleurotus eous and Pleurotus platypus were subjected to analyses the vitamin – C among these two species Pleurotus platypus were showed the maximum (5.81±0.73mg/100gm) but Pleurotus eous showed (4.60±0.50) mg/100gm of vitamin – c. due to presence of vitamin – c antioxidant activity were high.

Conclusion:
The present study was revealed that fresh edible mushroom (Pleurotus platypus and Pleurotus eous) contains more nutritional value based on the agricultural substrates. Results suggested that to consume as a nutritive food to outbreak the malnurition. Cultivating the edible mushrooms in various agro-wastes are ecofriendly substrates and economic substrates.

Acknowledgement:
I express my thanks to my parents and guide - Dr.A.Panneerselvam, Associate Professor, PG and Research Department of Botany and Microbiology, A.V.V.Sri Phuspam College (Autonomous), Poondi, Thanjavur, Tamil Nadu.

Reference: